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Proceedings of Maritimes Science Advisory Processes to Assess Bay of Fundy Scallops (*Placopecten magellanicus*) in 2008, 2009, and 2011

11-12 December 2008
9 November 2009
16-17 November 2011

Dartmouth, Nova Scotia

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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TABLE OF CONTENTS

SUMMARY v
SOMMAIRE vi
11-12 DECEMBER 2008 1
INTRODUCTION 1
ASSESSMENT OF BAY OF FUNDY SCALLOP STOCKS 1
Introduction 1
Status of Scallop Production Area (SPA) 1A 1
Status of SPA 1B 3
Status of SPA 3 3
Status of SPA 4 5
Status of SPA 5 5
Status of SPA 6 6
Summary of SPAs 7
DISCUSSION 7
CLOSING REMARKS 8
9 NOVEMBER 2009 8
INTRODUCTION 8
ASSESSMENT OF BAY OF FUNDY SCALLOP STOCKS 9
Introduction 9
Status of SPA 1A 9
Status of SPA 1B 11
Status of SPA 6 11
Status of SPA 5 12
Status of SPA 3 12
Status of SPA 4 13
Summary of SPAs 13
Discussion 13
RESEARCH RECOMMENDATIONS 15
CLOSING REMARKS 15
16-17 NOVEMBER 2011 15
INTRODUCTION 15
ASSESSMENT OF BAY OF FUNDY SCALLOP STOCKS 16
Sources of Information 16
Assessment Approach 16
Reference Points 19
Status of SPA 1A 20
Status of SPA 1B 20
Status of SPA 4 21
Status of SPA 3 22
Status of SPA 5 23
Status of SPA 6 23
Bycatch 24

Habitat Impacts 25
SUMMARY OF DAY ONE 25
Assessment Approach: Area-Based Advice 25
Data Inputs 26
Other Indicators 27
Model 28
Reference Points 28
Advice 28
Bycatch 28
Discussion 29
Habitat 29
Discussion 30
PRESENTATION OF NEW DATA 30
RESEARCH RECOMMENDATIONS 31
CLOSING REMARKS 32
REFERENCES CITED 33
APPENDICES 34
Appendix 1a. List of Participants: 11-12 December 2008 34
Appendix 1b. Terms of Reference: 11-12 December 2008 35
Appendix 1c. Agenda: 11-12 December 2008 36
Appendix 2a. List of Participants: 9 November 2009 37
Appendix 2b. Terms of Reference: 9 November 2009 38
Appendix 2c. Agenda: 9 November 2009 39
Appendix 3a. List of Participants: 16-17 November 2011 40
Appendix 3b. Terms of Reference: 16-17 November 2011 41
Appendix 3c. Agenda: 16-17 November 2011 42

SUMMARY

Regional Science Advisory Processes to review the assessments of Bay of Fundy Scallop stocks (Scallop Production Areas 1-6) were held on 11-12 December 2008, 9 November 2009, and 16-17 November 2011. Participation in these meetings was similar, including Science and Resource Management participants from Fisheries and Oceans Canada (DFO), fishing industry participants, participants from aboriginal communities, and the province of New Brunswick. The results of these meetings were used to support management decisions related to the subsequent year's fisheries. No science advisory meeting for Bay of Fundy scallop was held in 2010.

Compte rendu des processus d'avis scientifique de la région des Maritimes pour l'évaluation des stocks de pétoncles de la baie de Fundy (*Placopecten magellanicus*) en 2008, 2009 et 2011; les 11 et 12 décembre 2008, le 9 novembre 2009 et les 16 et 17 novembre 2011.

SOMMAIRE

Les réunions du processus d'avis scientifique régional destinées à analyser les évaluations des stocks de pétoncles de la baie de Fundy (zones de production de pétoncles 1 à 6) ont eu lieu les 11 et 12 décembre 2008, le 9 novembre 2009 et les 16 et 17 novembre 2011. Les participants à ces réunions étaient les mêmes et incluaient notamment des représentants du Secteur des sciences et de la Gestion des ressources de Pêches et Océans Canada, de l'industrie de la pêche, des collectivités autochtones et de la province du Nouveau-Brunswick. Les résultats de ces réunions ont servi à appuyer les décisions de gestion concernant la pêche en 2012. Aucune réunion de consultation scientifique pour le pétoncle de la baie de Fundy n'a eu lieu en 2010.

11-12 DECEMBER 2008

INTRODUCTION

The Chair of the meeting, T. Worcester, welcomed everyone and thanked them for coming in difficult weather conditions. Participants introduced themselves (Appendix 1a) and the two internal reviewers (R. Claytor and I. Jonsen) were identified.

The Terms of Reference for the meeting were reviewed (Appendix 1b).

The Agenda (Appendix 3) was reviewed, and nothing further was added. It was noted that a meeting would be held at the end of the first day to discuss survey design.

Everyone was invited to participate fully in the discussion and contribute knowledge and expertise to the review; however, discussion would be limited to science issues, not management ones. The role of industry was to make sure that the information brought forward was accurate and makes sense, and to bring forward any other relevant information or experience that would help better interpret this information. The role of the reviewers was to ensure that the analysis conducted is scientifically sound, and that the assessment team has used appropriate methods and drawn reasonable conclusions. Management's job was to make sure the right questions have been answered. The rest of the participants were encouraged to ask questions of clarification and to make sure that the way the information was presented would make sense to a broader audience. Participants were also welcome to submit written comments at the end of the day.

ASSESSMENT OF BAY OF FUNDY SCALLOP STOCKS

Working Paper: Scallop Production Areas in the Bay of Fundy: Stock Status for 2008 and Forecast for 2009. CSA Working Paper 2008/22.

Presenter: S. Smith
Rapporteur: T. Worcester

Introduction

There was a presentation of the Bay of Fundy Scallop management areas, data used in the assessment, and changes to the assessment since 2007, including changes to strata boundaries and changes to the exploitation and reference point evaluation. Overall survey results for the Bay of Fundy in terms of adults, pre-recruits, and clappers were presented.

Discussion

There was some discussion of the use clappers as a proxy for die-off (mortality estimate).

Status of Scallop Production Area (SPA) 1A

Information provided on the status of SPA 1A in 2008 can be found in Smith et al. (2009) pages 4-7.

Discussion

Exploitation by Average Meat Weight Graph: It was asked whether something other than 0.2 would be used next year. It was explained that 0.2 was left in this year so that people can see what is being done. Where the exploitation rate is set will depend on what strategy is being applied. For example, do you want to keep the population size the same or do you want to eat into the new recruitment? This assessment is not trying to say what the industry should do, but it

is trying to assess what the consequences would be given the current population structure. Does it take into account pre-recruits? Next year that number will change because pre-recruits become recruits. This is based on survey catch rates.

Decision Table: It was asked whether the model tends to overestimate biomass in the following year, and, if so, how does management take this into account. It was explained that the model attempts to project to 2009. The decision table does not take this into account explicitly. It overestimates the percent change.

Survey Meat Weights: Survey meat weights are much better than commercial meat weights.

Commercial Meat Weights: It was noted that commercial meat weights are just reported in a table; they are used in the assessment. There is a desire to use the commercial meat weights to better understand the fluctuation in the catch rates. Animals go through fairly big changes seasonally. When the fishery fishes depends on the yield and influences commercial catch rates. There is a need to look at where the effort is distributed. When there is an increase or decrease in catch rate, it is important to know whether this is a change in the stock or just a change in fishing activity. The database is not in order well enough to do this in the current year. Want to do it next year.

It was suggested that there could be better assessment of commercial meat weights if fishermen were used rather than firms. It was noted that the assessment team has started looking at observer data in last few months. There is still evidence in it that there are seasonal changes. Do have five years of data. Some staff did measure meat weights around Digby, Nova Scotia (NS) over a period of time for comparison.

Reviewer Comments

One reviewer asked how the survey strata are defined, whether they had been aligned with the management areas, and how well do they reflect gradients in abundance. It was explained that when they were established, they were part of a "changing boundary" scheme. Since that time, they were averaged and fixed in place. They have not been changed subsequently other than to line them up with the management areas that came into being after the survey. The Middle Bay South area was added back in the 1990s. It was defined to fill in the rest of SPA 1A. At one point, there had been an overlap in survey areas, which has been fixed. Some low density stations from Cape Spencer have been removed. It was suggested that there is a trade-off between aligning with historic abundance and gaining in convenience.

It was suggested that it might be useful to combine a retrospective approach with the forward looking approach. However, there was more concern with how the model is projecting forward. So, looking at the earlier years will help with understanding of the sensitivity of the model, but that is not going to be used to make decisions. It would be interesting to see how the prediction compares to the estimate a few years back.

Another reviewer asked for greater clarification on how stations are assigned to strata. It was clarified that stations are assigned randomly within the strata. The big change to SPA 1A is the overlap near Cape Spenser. Part of the motivation is to provide advice in smaller areas. This advice is only one fleet, one total allowable catch (TAC). For SPA 1B, it's more complicated. Tend to model the whole thing, not separate areas. This helps Resource Management apply their allocation formula.

Status of SPA 1B

Information provided on the status of SPA 1B in 2008 can be found in Smith et al. (2009) pages 7-10.

Discussion

Only a trip or two were made in 28C, as the lobster fishery is going on, and there is lots of gear in there right now.

The catch rate graph should end in September.

Minas Basin is just a strata label and is not related to the management areas.

Clappers are larger shells; not seeing smaller shells live or dead. Smaller clappers may not last very long. Model estimates that they may last 2.5 months.

It was noted that the survey was not seeing as many pre-recruits as anticipated. It was noted that the advice for 2009-2010 did not take into account the current pre-recruits.

It was asked whether there is a minimum distance between stations, as it did not appear to be random. The minimum distance is half a mile.

Reviewer Comments

It was asked why there were no bootstrap intervals on the pre-recruits. It was noted that these were calculated, but it was felt that these cluttered the graph.

It was asked whether a lack of stations in certain spots affected the biomass estimate. It was noted that the way stations are allocated from year to year is to minimize any systematic bias. When there is a patchy distribution, there will be a lot of variability.

It was suggested that information could be used from earlier in the time series. Fixed effects estimates are used to calculate meat weight in the next year. It would be possible to take the geometric average of recruitment and use that in the forward projections. This could lend more precision than exists here.

It was asked why the model was not fit to both the survey and the catch rate index. It was explained that this was done last year, but the catch rate index did not add any new information. The biomass estimate trends line up well with the commercial catch trends (not in scale).

It was asked whether there was any concern about annual variability in growth. It was noted that this was taken into account in the yields. The model of meat weight to shell height takes into account where and when a scallop is. The assessment team is trying to get more years with growth and age information to determine how much variation there is from year to year. They are using an average growth function at the moment. As more shells are aged, this can be added to. When the assessment team looked at 5-year bimonthly sampling, they saw some big differences in growth with respect to meat weight and age. Shell height and age did not vary as much. It is not possible now to project over the next year.

Status of SPA 3

Information provided on the status of SPA 3 in 2008 can be found in Smith et al. (2009) pages 10-12.

Discussion

There was some discussion about closed areas. It was asked why there was no fishing in the closed area in 2007. It was noted that people thought there was a variation order, which turned

out not to be in place. It was asked what sizes were observed in 2007 in the closed area. They were 30-50 mm. It was asked whether there was any chance that they just did not grow much and were the same ones seen in 2008. It was noted that the mode is smaller in 2008. It was suggested that there would probably not be much fishing in the closed area this year if there are no commercial sized scallops there. There were two closed areas this year that did not work; one was suggested by science and one was suggested by fishermen. Closed areas were felt to be a good potential tool, and there is evidence that closed areas on Georges Bank have been successful. Americans have also had good success with closed areas. However, a combination of good growing conditions in closed areas might be required.

It was asked whether the assessment team had any sense of a critical biomass level. It was suggested that low biomass would have economic consequences (i.e., fishing would stop) before biological ones.

Meats found in November were better, which was expected.

It was asked whether a small scallop would survive better in fast water or slow. It was suggested that they willnot survive in a fast current or a slack one; they need something in between. Scallops need exposure to some current for feeding, but they do not want to get taken away by it.

It was asked whether there was any way to find out what happened to the small scallops. It was noted that the survey saw small shells, so it is assumed that they died. Do not know if they are getting transported away.

It was asked whether a storm that damaged lobster could damage scallops. Tropical storm Noel was not strong in Brier/Lurcher. Storms can damage scallops and may have had an impact on the high mortality event. Scallops probably died over the summer. Also, they may not be getting enough food.

Reviewer Comments

It was asked how the plot with the replacement line can be reconciled with a decision table based on a fixed reference level (constant versus variable). The response was that there is no need to reconcile them. In some areas, a constant rate is ok. This area is more of an exception to the rule. If you can get away with a constant rate, that makes it easier. If you cannot, than use the additional information to make decisions. Recruitment is not great right now. It was suggested that both pieces of information should be presented, but the decision table only has the one. A percent change column has been added. It was suggested that the 0.2 reference should not be emphasized, and it was noted that if it is decided that a constant rate is not useful, then it can be dropped.

It was asked what the assessment team thought was going on with model. They felt that recruitment is not quite being captured, but it might not be too bad.

It was noted that if the model is over-emphasizing the decline, then it's precautionary. Again, it's probably going to be an economic decision more than anything. The biomass did increase after the 2002 fishery after only 30 t was removed.

There may be different dynamics going on between St. Mary's Bay and Brier. Where is the bulk of the fishery? Historically, St. Mary's Bay has had better growth rates. Brier has been better more recently.

It was asked what the effects of the closed areas had been for scallop. Results suggest that there was some benefit for commercial size scallops but not for juveniles. The closed area is offshore in SPA 3, where it's harder bottom. It is a marginal area without good water flow. Every

once and awhile, see change with plankton and broader oceanographic changes. This is the first time that a closed area has been used in this area. It does not mean that it would not work in the future. The Inshore Scallop Advisory Committee (ISAC) will decide.

It was asked why oceanographic information had not been incorporated. It was noted that J. Sameoto is working on some of this, but it should be used with caution as there are questions about scale. Oceanographers deal with different scales than the fishery, so the data may not be precise enough for fisheries assessment purposes. Geology might be more useful, and there is access to bathymetry now (e.g., OLEX collected by fishermen).

There were questions about the scale of scallop patchiness. It was noted that this depends on where you are. There are some areas where good patches are just the width of the gear. It was suggested that small patches with high densities of scallop settlement are more likely to do poorly than larger patches of scallops. In 2007, there was a big area of juvenile scallops, and there was hope that these would survive.

Status of SPA 4

Information provided on the status of SPA 4 in 2008 can be found in Smith et al. (2009) pages 13-14.

Reviewer Comments

It appears as though there was enough recruitment in this area to account for losses. In 2006, there was not enough. In 2007-2009, there seems to have been enough to compensate, as the biomass is staying fairly level.

This scallop population is getting older and less productive.

This assessment seems to be good at predicting when recruitment comes in. Other than that, the catch stays the same. Could you just keep the TAC at 100 t and wait until a recruitment pulse comes in? ISAC could ask for advice on this question, but they probably will not.

A question was asked about recruitment in the closed area. The area that was closed only included one patch of young scallops. It did not include large numbers of the next size class up. It was agreed that there does not seem to be a reason to keep it closed.

Discussion

Some fishermen reported that there are a lot of small scallops in that area, so it is not clear why the survey does not see them. The understanding of the fishery about what's happening there is very different from what the survey sees. It was noted that the survey has very good sampling intensities.

It was asked why opening SPA 4 would not lead to increased TAC for the area. It was noted that the assessment is for the whole area, which includes the closed area.

Status of SPA 5

Information provided on the status of SPA 5 in 2008 can be found in Smith et al. (2009) pages 14-15.

Discussion

It was clarified that "hours" referred to the time fished (not the time in the water).

It was agreed that it was not really worth saying anything based on a single sample (n=39).

Status of SPA 6

Information provided on the status of SPA 6 in 2008 can be found in Smith et al. (2009) pages 15-16.

Discussion

It was asked why there had been a spike in catch rate in Full Bay fleet in 2003. There was a small amount of fishing in the last few years. There are more records in the Mid Bay fleet.

It was asked how the survey compares to the commercial catch rates. It was noted that the survey does quite well with different gear (Digby gear with no teeth).

Only a few boats fish in SPA 6C, with a few more in recent years. They use a mud drag.

It was asked how the low sampling effort in this area affects the comfort level with the assessment. Comfort with the assessment is not high; a flag of concern would be a decreasing catch rate.

It is hard to know whether catch rates would stay the same if the number of boats increased given the rough bottom. When catches are higher, catch rates do not change a lot. Catch rates were not great here compared to anywhere else. Even if there were more boats, they would each fish a different area.

There could be changes in this area this year given changes in fuel prices and issues with lobster prices. There could be more fishing of scallops.

Reviewer Comments

Questions were asked about the double sampling. It was clarified that this was a way of being more precise without increasing the number of tows in the survey. It was asked whether it would be possible to do double sampling if the number of tows were reduced again to the minimum. The response was that this would have to be investigated further, but was expected to be possible. This area does not seem to be dynamic, but it's also highly patchy. It is an area asking for a solution.

There was a question about the status of video trials as an alternative survey method. This area has very rough bottom, which might destroy the cameras. There does not appear to be another alternative but to increase the number of survey tows.

A question was asked whether there might be one area of the survey that had good coverage, which could be focused on. For example, recruitment seems to come from Duck Island Sound, which is quite an independent area. However, it was noted that 10 stations are already done in that area. If there was another area, it might be possible to compare trends in that area to what is going on with the catch.

The strategy of concentrating survey stations versus spreading them out was discussed. Pros/cons: major tonnage is coming out of SPA 6C, which is the area with the most problems. Could just sample in SPA 6A and project to other areas, or look at past data.

The TAC in 2004 and 2005 was 195 t, then 2006 was 100 t, and now it is back up to 140 t. It does not appear to be based on biological or scientific advice.

It was suggested that the TAC should just be set to the catch. The reason is that just because the fishery is not catching the TAC does not mean that they could not. The TAC has not been limiting.

It was noted that the assessment team would consider alternative approaches when planning the survey for next year.

Summary of SPAs

A summary table was presented with suggested TACs for 2009.

Discussion

The assessment team asked how this summary table should be presented at ISAC. It was felt that the presentation format was good, though it was not clear how much explanation would be required.

DISCUSSION

Exploitation Rate

It was questioned whether a constant exploitation rate was acceptable, and, if so, whether the reference should be 0.2 or 0.15. It was clarified that these values were calculated differently, and that might be confusing to people. It was suggested that the first column of the table should be removed, with more explanation included in the Research Document.

New Stratification

The new stratification results in an increase in SPA 1A and a decrease in SPA 1B.

It was noted that there are still a lot of small areas with the new stratification, but at least they were ones that would be useful. It was suggested that while it may be useful to summarize by 28D and 28C, etc., information on a finer scale of resolution was still often requested.

It was suggested that there may be greater interest in the some of the Inner Bay of Fundy areas in the future.

Hopefully, the precision of the survey design is being increased through the increase in the number of strata. It was asked whether the primary goal was to better describe population dynamics.

A question was asked about how things would be done differently if the surficial geology for the Bay of Fundy was available. The response was that it could be used to better locate scallop grounds within the areas. It could be used to define higher density and lower density zones. It was noted that multibeam surveying has been done, but Natural Resources Canada has not completed the geological interpretation. Fishing effort can also help to define the boundaries of the scallop beds. They are more localized in the Upper Bay of Fundy. Where multibeam has been done, it could be used (along with video) to groundtruth the bottom type, which has been done for Scallop Fishing Area (SFA) 29.

A question was asked about when a framework review might be required. It was noted that the changes to the assessment have been incremental, and the assessment team is presenting advice in the way that it's needed. The next big change may be in the survey vessel, or there may be a need for a 10-year review. A change to a video survey or in the model would also be triggers.

In the US, a scallop survey was done with video. It was a dropped pyramid camera frame approach, and it gives information on what else is there (bycatch, bottom type). It is used supplemental to the NOAA dredge survey. However, it provides similar information to the dredge survey. Industry supports it directly with funding. It has been consistent and useful so far, but they still do the dredge survey also. They hire undergraduate students to do the interpretation. Another survey is done from Woods Hole that uses a towed camera system.

It was asked how the costs of video and dredging compare. This response was that this analysis has not been done, but the cost of analysis was expected to be higher for video surveying. It was noted that samples are still required to get meat weights. Given the amount of area you can cover, with good weather, it was expected that vessel time would be cheaper and there would be broader coverage on the water. Video surveys are done with fishing vessels.

It was suggested that there are other ways to do surveys, e.g., shrimp and snow crab. Efforts could be made to try to hybridize with LaRocque funding. Additional work would be required to explore this option.

It was asked whether the replacement vessel for the Hart would be used, or whether the survey would be done with industry. The response was that the preference was to continue to work with commercial vessels if the current framework is used. If there was a switch to a video survey, there may be a desire to go with something different, but commercial vessels could still be used. The replacement for the hart is supposed to replace three different vessels, so there will be other people who need to use it.

Bycatch

Money was provided by the Species at Risk program to look at bycatch in the scallop fishery. This is the first year with any observer data collected, and there are some questions about its validity and timeliness. For example, there were questions about the reliability of species identification, sampling methods, and the precision of the reporting. It needs some work.

It was asked whether there was anything that could be done to improve the reliability. It was suggested that the observers were not actually recording real information, i.e., there were reports that some did not leave wheelhouse. DFO has been informed of this problem, and it is hoped that something would be done about it. Captain should have a description of what the observers are supposed to be doing, so that they know when they are not doing their job.

Action: K. Clark will distribute the observer protocol to industry representatives.

It was asked whether a bycatch analysis would be presented next year. The response was that the data would be analyzed over the next year and something would likely be presented next year.

It was suggested that repetition of E. Kenchington's work every ten years to characterize bycatch diversity would be useful.

It was noted that no work has been done on direct physical impacts to habitat. Information is only provided on where sensitive species occur. Natural Resources Canada has been providing information also to DFO Oceans Management.

CLOSING REMARKS

Someone asked why closed areas do not seem to work here. It was suggested that this should be explored further, perhaps by using camera/video to look into this some more.

9 NOVEMBER 2009

INTRODUCTION

The Chair of the meeting, T. Worcester, welcomed everyone and thanked them for coming to this Science Advisory Process. Participants introduced themselves (Appendix 2a), and the invited reviewer (Jamie Gibson, DFO Maritimes Science) was identified. It was noted that this

year's assessment was slightly different from previous year's assessment in that it was conducted as a "condensed" review. The intent was to alternate years, with a more rigorous review of the methodology and assessment approach in one year, and a focus on the data inputs and application of the assessment approach in the subsequent year. In the year with the more condensed review, like this year, there would not be a new research document – the previous year's research document would be referenced instead. There would still be a detailed presentation of the results and a review of the Science Advisory Report. This format would still allow for discussion of issues that arose during the year that may have influenced results, as well as discussion of research recommendations and issues for further analysis in the more detailed review.

The Terms of Reference for the meeting were reviewed (Appendix 2b).

The Agenda (Appendix 2c) was reviewed, and nothing further was added.

Everyone was invited to participate fully in the discussion and contribute their knowledge and expertise to the review, but discussion would be limited to science issues rather than management ones. The role of industry was to make sure that the information brought forward was accurate, and to bring forward any other relevant information or experience that would help to better interpret this information. The role of the reviewer was to ensure that the assessment method had been applied appropriately, to ensure that reasonable conclusions were drawn, and to provide suggestions for further exploration.

ASSESSMENT OF BAY OF FUNDY SCALLOP STOCKS

Working Paper: Assessment of Scallop (*Placopecten magellanicus*) in Scallop Production Areas 1 to 6 in the Bay of Fundy. CSA Working Paper 2009/027.

Presenter: S. Smith
Rapporteur: T. Worcester

Introduction

Presentation Highlights

The assessment team reported that they appreciated the reduced paperwork of the condensed meeting format. Management boundaries were presented. It was noted that there had been some increased observer coverage in this fishery for the Species at Risk project, which has been led by a group at the Saint Andrews Biological Station. When the analysis of this new coverage is done, it will require review. In general, there were generally lower densities of scallops observed in this year's survey, with some hotspots. There was only two major recruitment hotspots noted, around Advocate, NS, and on the New Brunswick side along the 28C, Mid Bay North strata boundaries. Clappers were low everywhere with no obvious mortality events.

Discussion

It was asked whether the strata boundaries were still working well. It was clarified that they were.

Status of SPA 1A

Presentation Highlights

Only the Full Bay Fleet fishes this area. The 2008/09 TAC was set to 265 t, with landings of 267 t. Catch rates have been fairly stable the past 4-5 years, but effort has increased. Strata 11

in the 8-16 nm area off of Digby is not covered anymore as there are few scallops. It is not included as part of the biomass estimate. There was a large 1998 year-class in parts of SPA 1A (8-16 nm zone). There have been no large year-classes since this, though there has been a low level of annual recruitment. The model seems to fit fairly well within a time series. The forecasting results were also checked, and there seems to be a strong retrospective pattern with a major biomass correction downwards. A fishing mortality of 0.2 is considered to be a reasonable limit if it is not clear what the population is going to be next year. It is felt that there is a pretty good understanding of growth, but it is not possible to predict future recruitment.

Reviewer Comments

The reviewer asked whether recruitment and commercial catch per unit effort (CPUE) were included in the model. It was clarified that recruitment is included but that commercial CPUE is not. The commercial CPUE looked so similar to the survey trend that it was not felt that it would add anything. However, CPUE is used as an independent check on the model. It was surprising how well the survey and CPUE agreed. It was noted that it would be possible for the fishery to target areas of higher productivity, so it was not clear why the survey and CPUE would agree. It was noted that they did not agree in Area 3. There was general agreement that this is a good way of doing things.

It was also clarified that the "replacement line" included recruitment and growth, but the points included next year's recruitment.

Questions were asked about the selection of the range of catches, as they seemed to vary from area to area. It was noted that catches close to what was observed last year are selected.

The reviewer asked how this translates into a TAC recommendation for next year. The response was that it is determined at the stakeholder advisory committee.

Questions were asked about the clapper data. It was noted that the clapper data goes into its own population model. Clappers "die" when a hinge breaks; this is based on a process whereby the hinge is slowly broken down by bacterial action (or it could be mechanical impact). Some lab studies were done on this process years ago. There was a massive natural mortality event in 1989-90, but fewer clappers have been seen lately. It was noted that the fishery is not seeing any additional mortality.

It was noted that the biomass estimate could be out by 20% (approximately). The reviewer asked whether a decrease in biomass might be observed at even lower catches, and whether it would be possible to try a retrospective correction. The response was that this had not been investigated.

Discussion

It was asked how the impact of the survey over-estimation in the decision table was evaluated. The response was that an attempt is made to describe this in the text for the Science Advisory Report, as it does need to be taken into account. The advice is that there should be caution when you get close to the catches that result in only small or zero increase in biomass.

It was asked whether there is a lag in the ability of the survey to detect recruitment. The response was that recruitment is observed before it enters the fishery. If it is a very strong year, it is definitely observed, but it is not always clear what the strength of the recruitment is until the year before it recruits to the fished population. This is similar with the fishery; recruitment is not observed (do not see many of them) until they get bigger. It's a catchablity issue. The survey gear does have a liner, so it is possible to catch them. With the last big year-class, a very fast growth rate was observed.

Status of SPA 1B

Presentation Highlights

Fishing seems to be occurring in areas similar to areas of density in the survey. There has been a decline in the catch rate in SFA 28D. Do not really see a strong 1998 year-class in Cape Spencer. There has been some recruitment in Middle Bay North, close to SFA 28C boundary, and there have been some strong signals going through in SFA 28C. Advocate is a very productive little area. A reasonable signal of recruitment can be seen there, which does not always show up later. SFA 28D has low densities of scallops, with a small amount of recruitment. Spencer's Island is a reasonably productive but small area. There is some recruitment in Scots Bay. SFA 28B and 28C are showing recent declines in catch rates, though there is some recruitment coming in. Scot's Bay is the only area showing an increase in commercial size scallops in recent years. There is slightly higher natural mortality in this area. This year, there was a major revision in the model projection – it projected higher biomass than was seen in the survey. Growth is slower in this area and natural mortality is higher, so the replacement line slope is steeper.

Reviewer Comments

Concern was expressed about the bias in the model and the percent change in the decision table. It was suggested that it would make sense to choose a percent change from 5% decrease to 10% increase and then calculate the catch that corresponds (trying to provide a range around 0% increase).

Discussion

It was asked how many logbook locations are mapped. The response was that one location per day was taken from the logbook. Some of these line up on top of each other.

It was noted that this area has generally been in the range of 20% exploitation rate. Sometimes, it has been higher.

It was asked how the commercial catch rates compared to the survey catch rates. The response was that commercial catch rates did not show the decline that was seen in the survey, though there were some declines in 28D. There has not been a huge change observed in where the fishery is occurring based on the logbooks.

It was suggested that logbooks are not a good source of information for this area, as there is one fleet that is monitoring 100% and one fleet that is monitored at 20%. However, it was noted that there does not seem to be a big difference in the two fleets. As far as catch rate goes, a comparable picture is observed.

Status of SPA 6

Presentation Highlights

SPA 6 is divided into 4 subareas (6A, 6B, 6D, 6C). It is fished by both the Full Bay (not much recently) and Mid-Bay fleets. The 2008 TAC was 140 t, with landings of 90 t. The area is hard to assess given its patchiness; there has mainly been monitoring with survey information. Commercial catch rates are based on small amounts of catch. There has been some cutting back on sampling effort, as there is no agreement with the Mid-Bay fleet to assist. The survey in 6C has never been adequate, and this year was concentrated on Campobello with no sampling in Passamaquody Bay. Some sampling was done around The Wolves, with no small scallops, but some the next size up (not as many as were expected). Things are looking quite good in subarea 6A, and there are some good signs of recruitment. Survey commercial sized numbers

are increasing, though with a reduced number of sets, there is less confidence in these results. This is similar for 6B. In 6C, it is hard to compare to previous years, but some recruitment has been observed around Campobello. The densities of commercial sized animals are much higher. The survey was done after the fishery was completed. There is no reason to increase the TAC since it has not been caught, but there are good signs overall.

Discussion

It was asked how big the scallops seen would be now (Wolves). The response was that they would be about 65-76 mm and not catchable this year, but likely next year.

It was asked whether there is any reason to close Duck Island Sound. The response was that there is no scientific reason to do so; it was only closed in the past to protect recruitment.

It was noted that there has been no change in clappers, but only the north side of the Wolves was sampled.

Status of SPA 5

Presentation Highlights

This area is fished by the Full Bay Fleet only. The 2009 TAC was set to 10 t, with landings of 5.7 t. The annual survey was discontinued in 2009. Only commercial catch rate is available as an index, which is down a little but from last year. There had been some evidence of recruitment, but not much. The recommendation was that the 2010 TAC should not exceed 9 t (average catch).

Discussion

This analysis seems consistent with what the fishery has observed.

Status of SPA 3

Presentation Highlights

There has been a decline in fishing of outside areas, and fishing is mostly occurring along the coast. If you look at bottom type, it's mostly drumlin type bottom that has been eroded by wave action. There is rougher bottom and more patchy scallops offshore with lower yields. There has been a decline in TAC and landings. Catch rates have been stable over the past three years, reflective of St. Mary's Bay area. The survey does cover the whole area. A large number of little scallops were observed in the box, but no two-year olds. There were not many clappers in the whole area. It is mysterious why the recruitment does not come into the fishery. Survey trends have been declining since 2004 in Brier/Lurcher. St. Mary's Bay is pretty stable. In the box where fishing has not been occurring, the population was stable but then declined in the last year. The model cannot handle this pattern. There is no evidence that natural mortality is higher. The Full Bay fleet suggested re-evaluating the model in terms of productivity over the area. Satellite information has been reviewed, but there is not sufficient information to look at finer scale detail. It's not clear what might have changed.

Reviewer Comments

The reviewer asked how wide the survey standard errors were. It was noted that the decline in the last year is statistically significant, and there has been better precision over time.

Discussion

It was noted that a few fishermen have found some areas where they can catch scallops. However, they used to be catching them across a wider area. They used to catch a large number of scallops from that area, and now it's virtually commercially extinct. There have been reports of seeing a different bottom type, and perhaps there has been a change in temperature.

It was asked whether the boundary of Area 2 could be moved. The response was that the assessment team would like to map growth first.

DFO Science is not recommending more catch from the inshore area, as it needs to be investigated further, particularly areas where scallops are being found.

It was suggested that if there starts to be a decline in St. Mary's Bay, then something is definitely wrong.

Status of SPA 4

Presentation Highlights

This area is fished by the Full Bay Fleet only. The 2008/2009 TAC was set to 100 t, with landings of 98.6 t. A little bit of recruitment was observed in 2007. It's still there, but not as big as originally thought. There was a large mortality event in 1989-90, with mortality currently around 7-8%. The model revision has been much less this year compared to other areas. If the current TAC of 100 t was maintained, a decrease in biomass would be expected with not much recruitment coming in to replace it. There has been a slight decline in catch rate.

Discussion

These results were not considered to be consistent with that observed by the fishery, which is seeing more recruitment. It was asked whether it is possible that the survey is not catching the small scallops, as it fills up so quickly with other scallops. The response was that the trend in recruitment should still be observed. However, recruitment may be underestimated in this area.

It was asked whether it would be worthwhile comparing the commercial gear with the survey gear, to determine if recruitment is earlier to detect in the commercial gear. It was noted that some comparative tows would be needed for calibration purposes, which would be expensive.

It was noted that a Bryozoan species (*Flustra* sp., commonly referred to as lemon weed) has been spreading through the SPA 4 area for 8-10 years or more.

It was also noted that most of the fleet changed their gear in the early to mid-1990s. The new gear was felt catch scallops better despite the lemon weed.

Summary of SPAs

There are model issues with SPAs 1A, 1B, and 3, which are not as bad with SPA 4. The model seems to be having trouble balancing the survey trends with the catch.

The advice tables say that there should be an increase in biomass with the current harvest levels. The CPUE is stable in SPA 3.

Discussion

There was some discussion about what to do with the retrospective pattern, and whether it would be possible to place some bounds on the possible biomass levels given the retrospective pattern. It was noted that the assessment team would not be able to do this over lunch.

Questions were asked about camera gear to investigate disappearance of the recruitment.

It was noted that there would not be 40 days available to do the scallop survey on the replacement for the Hart vessel in the future. However, the scallop assessment will still be a major user of the new vessel.

It was asked how unreported catch might influence catch rates, as it is felt that there is lots of catch that is being landed that is not being recorded. The response was that it would not be expected to influence catch rates much. However, industry does feel that the catch rates may be influenced. It was noted that the model would work better if there was more catch than was being reported. Unreported catch might be worse where there is only 20% dockside monitoring. It was asked whether there might be a set of vessels that the catch rates might be considered more reliable, and whether those could be compared to the whole fleet. Another suggestion was that for any two boats that fish the same area, large discrepancies in landings should be monitored. It was suggested that boats with quota might be a better indicator. Also, "time fished" can be hard to determine.

It was also suggested that there might be enforcement options to deal with the issue of unreported catch.

For SPA 4, there could be decreasing survey efficiency over time due to lemon weed. There is new recruitment in SPA 4, so lemon weed is considered a problem there, as it fills up the gear quickly. It was noted that lemon weed is an issue wherever it occurs. It is a problem in SPA 1A, 1B, 4, and 5. It may influence the ability to detect recruitment. It has always been in the Bay of Fundy, but it has been spreading in the last 20 years.

The possibility of hyperstability in the CPUE was discussed. Alternatively, there could be a decrease in the survey efficiency. To test this, it might be possible to compare survey sites with nearby commercial fishing sets, or reduce the number of sites used to calculate the CPUE index. However, it was noted that the fishing vessels do move around and only record one location per day per trip. Efforts could be made to match logbook records to VMS records.

It was suggested that the model will not work in SPA3, as productivity is problematic.

It was suggested that each of the following need to be investigated: recruitment, growth, biomass, catch (evidence of unreported catch), and natural mortality (limited evidence of change).

It was suggested that there is no point in changing the current logbook reporting procedures; however, it might be useful to note the location of where most of the scallops are caught rather than just the first set of the day. However, it was noted that this might not make much difference, as the VMS and logbook records already match pretty well in terms of location.

It was noted that the European Union is going to use closed circuit television on fishing vessels.

Questions were asked about the port samples. The response is that not much is done with them. It was suggested that they be suspended by industry since they were not representative.

It was noted that the camera system used by the assessment team is now is at the end of its life. They are putting together a proposal to buy a new system, but they will need to have the equipment and the personnel to run the system. Camera work is the way to go with supplementary drag sampling.

RESEARCH RECOMMENDATIONS

Research recommendations include:

- Matching survey indices to the areas being fished.
- Investigating model issues.
- Investigating the impact of lemon weed / cauliflower. Try to use different gear, such as hinged frames or Irish drags.
- Investigating the differences between survey and commercial CPUE.
- Determining why the closed areas are not as successful here as in other areas, i.e., why recruitment is not leading to commercial scallops.
- Studies on moving juvenile scallops to new areas, though there does not appear to be evidence of success in other areas either. Could look at studies that have been done.
- Considering reference levels of 0.2 versus 0.15-0.16, i.e., whether it is still appropriate to use 0.2.
- Using commercial meat weights (next year).
- Further investigating seasonal and annual variation in weights/growth.
- Further investigating oceanographic or seafloor conditions in relation to scallop growth.
- Investigating video surveys.
- Studies on the effectiveness of closed areas (perhaps using camera work to look into this).

CLOSING REMARKS

M. Lundy will be retiring, and someone new will be hired; however, M. Lundy would hopefully be available for training of the new staff.

A summary of decisions on next steps were to be circulated shortly.

16-17 NOVEMBER 2011

INTRODUCTION

The Chair of the meeting, T. Worcester, welcomed everyone and thanked them for coming to this Maritimes Regional Science Advisory Process to assess the status of Bay of Fundy scallops. Participants introduced themselves (Appendix 3a), the Terms of Reference for the meeting were reviewed (Appendix 3b), and the Agenda (Appendix 3c) was referenced. Nothing was added to the agenda. One reviewer, Jae Choi, DFO Maritimes Science, was unable to be present at the meeting, but his comments were read aloud by the other reviewer, Kent Smedbol, DFO Maritimes Science.

Participants were invited to engage fully in the discussion and contribute their knowledge and expertise to the review, but it was noted that discussion would be limited to science issues -- not management ones. As usual, the assessment meeting was to be conducted in two parts. The first part of the meeting was the peer-review of the Bay of Fundy scallop stock assessment as prepared by the Maritimes scallop assessment team, including review of a working paper that had been circulated to participants in advance of the meeting. The second part of the meeting was the development of scientific advice (Science Advisory Report) based on this information. The Science Advisory Report was to be developed through the consensus of the meeting participants. For the purpose of this meeting, consensus was considered to be an absence of

opposition to the meeting conclusions and advice that were based on scientific data and information and not on external considerations such as the potential impacts of future decisions.

The roles of participants were described. The role of the science participants is to ensure that the assessment method has been applied appropriately, that reasonable conclusions have been drawn, and to provide suggestions for further exploration next year. The role of industry is to make sure that the information presented is accurate and makes sense, and to bring forward any other relevant information or experience that would help better interpret this information. The role of management is to ensure that the information is presented in such a way as to be useful for decision-making in relation to the fishery.

ASSESSMENT OF BAY OF FUNDY SCALLOP STOCKS

Working Paper: Scallop Production Areas in the Bay of Fudy: Stock Status for 2011 and Forecast for 2012. CSA Working Paper 2011/39.

Presenter: S. Smith
Rapporteur: T. Worcester

Sources of Information

A presentation was provided on the sources of information used in the current Bay of Fundy scallop assessment.

Discussion

It was asked whether commercial meat weights are being used in the assessment. It was clarified that these are no longer being collected and so are not being used. There is no other port sampling.

It was asked whether removals are being considered from other fisheries. DFO requires that all removals of a species are accounted for – not just from the traditional fishery. All removals from the inshore scallop fleet are typically included in the assessment. Catch for Food and Ceremonial purposes is now included when available. Scallops removed in the dive fishery are not included. It is assumed that discarded scallops survive, so these are not included in the removals.

There was some additional discussion on the dive fishery off Meteghan. It was suggested that some dive fishers work all day long and take more than they are allowed (100 scallops).

The usefulness of the Gavaris et al. (2010) report as a reference for other scallop catch was questioned.

Assessment Approach

A presentation was provided on this year's assessment approach, as well as issues that were identified in the previous (2009) assessment and the approach that was taken to address these issues.

Reviewer Comments

Note: As mentioned previously, the reviewer was unable to be present at the meeting, but his comments were read aloud. Responses of the assessment team are provided after each comment.

Comment 1: Overall, the methods seem reasonable. I do, however, find it unreasonable to have so much repetition for each subarea. I would think broad-scale coherence or lack of

coherence in patterns of abundance, and condition, catch rates, etc. would be more informative than the trends within each area being treated virtually independent of each other. This is especially problematic when the biological units (centers of distribution) are truncated by subarea lines.

Response: It is true that the SPA/SFA boundaries bisect some of the beds. However, scallops have very specific productivity depending on where they are. It is this local productivity that is being reflected. VMS (Vessel Monitoring System) data is being used to define where the centers of productivity are. Reference points also have to reflect productivity.

Comments 2: Time-space trends would be more informative for biomass density and condition, placed on a system-wide scale.

Comment 3: Condition analyses:

- Could have provided more diagnostics/statistical summaries of significance
- Day of year or month or seasonality effects were not included. They should be considered.
- Figures 2 and 3 look like they are showing confidence bounds excluding variance associated with mean. Not including it gives a sense of high precision. The variance should be added.

Response: There is a need to balance the size of the Research Document with the need to provide sufficient information for review. For this meeting, the standard diagnostics are available, including the posteriors, and the residuals look good.

It was recommended that, in the future, an Appendix with additional diagnostics could be developed that would only go out to the reviewers.

Comment 4: For most of the model runs, the posteriors are virtually identical. Consideration of an hierarchical model is, therefore, suggested. Further, how useful is it to forecast and model time series data when the spatial bounds of a subarea truncate a high density area (e.g., Figure 21)? It does not seem wise. Also, the priors for ql and S dominate the posteriors. Slightly less informative priors should be examined as a sanity check.

Also, it was asked why there is such great variation from year to year. Recognizing that it was not used, but it is interesting that the model is doing this. What is it trying to fit to?

Response: With changing catchability from year to year, the model tried to explain process error and tried to correct for it. It is better to let the model express the variability, and put the uncertainty back into the model.

Comment 5: Size structure suggests a worrying absence of smaller (about 77 mm) organisms, especially in recent times. When they were observed, they rapidly declined in relative density. As the models are trained upon survival when it seems to have been better, biomass forecasts should be taken with caution.

Discussion

Some seasonality in the condition factor is expected, but it was unclear whether this had been formally evaluated. There is a data set that could be investigated to determine how valid this is. Any increases or decreases over time are expected to even out. Scallop meats in October and November are greater than those in July. They will lose weight in winter, but gain it again in spring. In the assessment, it is the summer to summer change that is primarily being assessed (given the timing of the surveys). The Americans have been building seasonal models into their assessment, but these have been quite complicated, and it is not clear that this has resulted in an improvement to the assessment yet. However, this approach is still quite new.

Industry disagrees with the current division of Area 28A into smaller areas. They would currently prefer to have it combined into a single fishing area. However, this is primarily a management issue. The DFO Science assessment team will provide information based on the surveys that are conducted. As mentioned previously, there are some differences in productivity from area to area. If the management system changes (as the industry would like it to in Area 28), then Science could potentially provide information in a different way. While there might be changes in how the advice is presented, there would not necessarily be changes in how the data is collected. A bigger problem with combining areas is the sharing formulas. That's the biggest challenge.

The impact of having multiple smaller assessment areas was discussed further, particularly whether it mattered if a center of scallop biomass was bisected by a management boundary. It was commented that dividing the area up into smaller areas was a throwback to groundfish. The most productive areas could be fished first and potentially depleted before moving on to another area. The relevance of whether an area gets depleted or not by fishing was debated. It was felt that knowing how quickly an area could recover from depletion was important. Unlike fish, scallops cannot easily swim back in to an area to repopulate it. Recovery has to come from the local productivity. This is a different process from recovery of fish populations.

It would be useful to be able to more easily compare trends across areas.

It was asked whether the model for an area take into account the extreme differences within that area. The response was that it does, but it could do better at taking into account the habitat suitability within an area. Currently, this is done through growth as a surrogate for habitat suitability, and some time will be spent later in the assessment on the spatial distribution of growth. The assessment team is working on other ways to account for differences in habitat suitability.

A question was asked about the applicability of survey catchability (q) from Quebec. H. Bourdages looked at survey catchability around the Magdalen Islands. It was an issue in the Quebec Region, so they did some studies. They observed a catchability between 0.4 and 0.7 in these studies, which was higher than the catchability previously found in the literature (0.1 and 0.2). When the data were reviewed, it was apparent that the catch rates decreased day after day, which is not possible with a catchability of 0.1. It is possible that this same process is occurring in the Bay of Fundy. Industry is more efficient with their gear now than at the beginning of the fishery. The results from the Quebec study have been used to bracket/constrain the Bay of Fundy model. The survey tends to be more efficient off Digby, and this seems to make sense from what is known about bottom type. It may be useful to conduct similar studies with the Bay of Fundy fishery.

It was suggested that it might be possible to use a common assessment model with a different q by bed. There are definitely growth differences between beds. It was asked whether the change in q might be aliasing uncertainties in the change in productivity, but this was not considered likely. The change in the survey catchability should be a function of bottom type. From Area 29, where there is more data available, growth changes are still observed even if one takes into account the change in growth by bottom type. It was felt that these factors are independent. The model does not allow q to change very much over time.

It was suggested that the catchbility of fishing gear is closer to 0.1 than to 0.7. It was felt that when you can tow the same line day after day and not see any change in the catch, it could not be possible for the gear to be catching 40-60% of the scallops. It was felt that you'd be lucky to catch 5%. It was clarified that the catchability referred to previously (and in the model) was the survey gear catchability – not the fishing gear catchability.

Some comments were made about the ability of the model to predict what was going on in Area 3. Industry felt that the model was not providing meaningful information. It was noted that the CPUE and the survey were more consistent this year with the new Area 3 assessment boundaries.

Industry noted that they hoped for a management system that would allow for in-season increases in quota. There was a desire to make more money with less expense.

Industry felt that there was a need to talk about survey gear some more at the ISAC meeting. However, industry was reminded that the goal was to improve the ability of the survey to track changes in the scallop population and not simply to increase the efficiency of the survey gear. With respect to survey gear, it was noted that a new vessel would be coming from Coast Guard and that might be a good time to reconsider the survey gear and possibly do some comparative towing. The delay in taking on new gear was due to two things: money for the gear and a new boat. There will be a future meeting to discuss this issue. The new vessel may be an issue in the Bay of Fundy because there may be places it cannot go.

Last year, an effort was made to put together a science assessment working group (including industry) to help when the Bay of Fundy Scallop assessment moves to a multi-year cycle. This working group has not met yet, but it could be the forum to talk about these kinds of science issues. ISAC might not be the place to discuss science issues, but the results of the working group discussion could be reported at ISAC.

A question was asked about the lack of small scallops in the survey, specifically whether the tides are taking them away. In some areas, the survey captures catching the major trends in recruitment. However, it does not capture the finer scale resolution. Camera gear would be a great way to augment the survey, but there are budgetary constraints.

It was asked what the biggest uncertainties are in the model and how robust the results are to these uncertainties. The response was that attention needs to be paid to recruitment. The model pick up very strong and very weak recruitment. In between, there is some variability. Natural mortality estimates are also more reliable when they are high or low, but they are not precise in between. Based on the history of this area, there is episodic mortality and episodic recruitment, but the major driver is growth. It is important to be able to estimate what the growth is going to do next year, and the model is not able to do this. Projections are based on what's happening this year, which does not always work out. Some large annual changes in growth have been observed.

Reference Points

Participants were reminded that TAC recommendations would not be provided at this meeting. Years ago, it was agreed that the assessment would provide advice in terms of predicted exploitation rates. There is an exploitation rate above which scallop biomass tended to increase. In the past, this was an exploitation rate of 0.2 but now it is closer to 0.15 (from the 2008 assessment). Advice is also provided in terms of a percentage change in biomass. DFO now has a policy to look at reference points (the Precautionary Approach framework), as well as a Marine Stewardship Council requirement to develop reference points. The old method of determining the reference point was catch over biomass. However, it was determined that is would be better to take the biomass at the end of the year, and use the catch over the biomass at the end of the year plus the catch (add it back in).

Status of SPA 1A

A presentation was provided on the fishery, survey, and model results for SPA 1A. Details can be found in the associated Research Document (Smith et al. 2012) and Science Advisory Report (SAR) (DFO 2012) for this meeting.

Discussion

It does seem that the strata match well with condition and density. It was noted that the strata boundaries were designed in the 1980s to reflect fishing patterns. Middle Bay was not a traditional area that was surveyed. Fishing increased in that area, so it was included.

It was clarified that the exploitation graph shows the new catch over biomass plus catch.

It was noted that there seems to be a good pattern (or lack of pattern) in the forecasting. It does not seem to show a bias – sometimes up and sometimes down.

It was asked how the advice might play out as a multiyear assessment. The response was that DFO has not talked to the industry about it yet. Multiyear assessment advice would likely have to become more conservative. The diagnostics have not been done to evaluate the performance of the model to project more than one year.

It was clarified that the 0.15 exploitation rate is not considered a target. DFO wants to move towards targets or limits, but the 0.15 value is not intended as this. Above 0.15, tend to get biomass decline. This year, see decline a little before this but at very small levels. Recruitment is down.

Questions were asked about the replacement line graph. The old growth model was used to produce the replacement line graph. This is hard to do with the new growth model. Recruitment is low. Average size is high. Productivity is high.

Is was asked how the decision gets made about the percent change related to the TAC. The response was that industry has some input, and there should not be too large an impact on the population. Also, the industry has an idea of what TAC is desired. Industry provides a recommendation with a rationale.

If the entire TAC is caught, the only change in biomass is from the condition, growth or recruitment. The right side of the table relies on 2-years old that we're not as certain about. There is more certainly around the 3-year olds. More variability does not necessarily mean it's conservative.

Status of SPA 1B

A presentation was provided on the fishery, survey, and model results for SPA 1B. Details can be found in the associated Research Document (Smith et al. 2012) and SAR (DFO 2012) for this meeting.

Discussion

It was asked how big scallops get in a virgin population. The response was that in the inshore areas, they get quite large (130 mm). Do not see them this size in a fished population.

It was clarified that the line in the landings graphs is TAC.

It was noted that effort would likely be following the exploitation rate. This was considered a reasonable second check since the model does not include CPUE.

The survey was done more in July than August. Most years, the fishery has been closer to catching the TAC. Would assume that there'd be more left. However, there has been a steady

decline in condition. If condition had stayed the same, would probably also have seen more fishing. It is not clear why condition has declined. This should be investigated. Boats were in the Upper Bay as late as late September and they still had not seen any improvement in condition. Had seen some improvement in condition later in the year in the inshore. Area 3 was also good in the fall this year. Do know that there are issues with plankton – presented at the scale of the Bay of Fundy or Gulf of Maine. It is hard to evaluate ocean color maps close to land due to run-off from land, so it is not useful to interpret this at the SPA 1A or 1B scale.

It was asked how far back there was condition information from. The response was that this is information from 1996 onwards. There is some information from some areas further back, but it has only been systematic since 1996. It would be nice to know where the limit reference point might be, i.e., information that you could get from a longer time series. There is likely an anatomical limit before the scallop dies. There are areas with high condition and low condition. It was asked whether there has there been a change in catch in these areas. The response was that this has not been investigated at a fine scale. Density dependence has not been investigated either.

It was asked whether the current year's condition was used. It was suggested that another table could be provided that shows biomass projected with a further decrease in condition. However, it might not be useful as there are no data to base this on. It was suggested that a note should be made in the advice that condition has been declining.

Status of SPA 4

A presentation was provided on the fishery, survey, and model results for SPA 4. Details can be found in the associated Research Document (Smith et al. 2012) and SAR (DFO 2012) for this meeting.

Discussion

Catches levels are low compared to the big peak in the early 2000s, but they are consistent with historical level or average levels. It is at median levels. This assumes condition will stay where it is now, which is slightly above average.

Need to know how sensitive the advice is to condition assumptions over the long-term. In a Management Strategy Evaluation, could test the management regime (sensitivity to assumptions about conditions).

It was noted that there has been no discussion of uncertainty in the catches this year. The response was that Conservation and Protection had been contacted, and logbooks were investigated, but nothing could be resolved. There has been no feedback. It was asked how much unreported catch would be required to account for the observed uncertainty. The response was that improvements to the growth model had resolved some of the problems with the model, so the assessment team stopped looking at unreported catch. However, there is still unreported catch. It is unclear whether it has changed over time, though probably not significantly. If it could be quantified, it could be accounted for. It was suggested that if exploitation rate and mortality are not showing it, then it's probably not an issue.

It was noted that the Full Bay fleet is 100% dockside monitored, so unreported catch would not be coming from them. It was still felt that illegal landings are everywhere. It was suggested that fishing is occurring longer (more time on the water) even though TACs are smaller, but catch rates have not gone down. Quotas are why there is unreported catch. There is still a feeling that about 20% of actual landings is still going unreported (or may be 25-30%).

It was asked how CPUE is calculated. The response was that it is catch divided by effort calculated as the number of tows multiplied by average time on bottom for a day. However, it was noted that this would only be accurate if the effort is reported accurately.

It was asked whether there a big variation in the effort hours per day. The response was that there was, but there might be good reasons for that.

If there was more Conservation and Protection presence, it was felt that unreported catch would have a better chance of being detected. However, it was noted that you will not it on the wharf. The better the catches are, the more unreported scallop there is. If you looked at every boat every day, you might see it. They get grouped, so you do not see it. It was suggested that a forensic audit of the plants might catch it, but it was noted that the illegal catch was not going to the plants, it is being sold locally by trucks in parking lots. It was noted that sales slip does include crew shares (i.e., crew could be selling reported catch). Conservation and Protection has promised to look at it.

It was asked what the process might be for investigating unreported catch. It was suggested that there be a meeting of the three levels of government doing licensing.

Status of SPA 3

A presentation was provided on the fishery, survey, and model results for SPA 3. Details can be found in the associated Research Document (Smith et al. 2012) and SAR (DFO 2012) for this meeting.

Discussion

It was asked why the fishery is starting closer to the mouth of the Bay. The response was that it is closer with bigger scallops, usually, though scallops were good everywhere this year.

It was noted that "depletion" is a relative term. Even at their lowest levels, scallops were still better than in the Bay.

It was asked whether the inside and outside surveys for Briar/Lurcher were prior or post fishery in 2011. The response was that the survey was done after the fishery in June, but before the fall fishery in 2011.

It was clarified that the CPUE was just for the inner area.

It was asked whether there is a size/age process coming into play. The response was that it has remained flat during the problematic time period.

It was suggested that the population biomass appears to be responsive to fishing. Highest biomass appears to be seen in the year after a year with limited catch.

It was clarified that the whole fleet is used to calculate CPUE. However, individual boats have been considered, but this analysis has not been completed. When Area 3 looks good, new people jump into the fishery. They have a range of fishing success, and so the analysis will only be looking at the average.

It was suggested that sample size could be evaluated in the problematic years (proportion of spring and fall records). It was also suggested that spring bloom timing might be influencing the results (i.e., scallops put on weight in the fall). It was noted that efforts could be made to tease this apart. For many years, summer and October catch rates were similar.

It was clarified that there was no standardization of CPUE.

It was asked whether the decision table was only the inner fished area (VMS area), and how much additional biomass is outside the VMS area. The response was that the mean number per tow is scaled by the area. There has been no exploitation outside that area, though this could be determined more accurately for tomorrow. It looks like it's heading toward an inner and an outer fishery.

It was asked what the model result would look like if it was tuned to the CPUE only. The response was that it would look similar except for the last three years. It was considered to be interesting that it bottomed out three years earlier than the survey. Though, people were not bothering to go there in 2005-2007, since they were not catching the TAC.

It was noted that there is a high level of survey coverage in the area.

It was clarified that the catch rate is for the full hatched area, including the western patch that has not been fished. It was asked whether the small patch could be driving what's observed in the last couple of years.

It was noted that there used to be an SPA 7 (St. Mary's Bay). It was removed to reduce the number of management areas

After the break, the spatial distribution of the fishing effort was reviewed by season. It appears that catch rate is only coming from the inshore area in recent years (four of the first four years, and none from last four years). However, the survey is including this area. It was suggested that it would be interesting to see what influence this has on the survey trend, as that area has lower density and lower condition.

Action: It was agreed that the survey series would be split with and without that area from 2006 onward, and the new histograms would be produced.

Status of SPA 5

A presentation was provided on the fishery and advice for SPA 5. Details can be found in the associated Research Document (Smith et al. 2012) and SAR (DFO 2012) for this meeting. There was no discussion of note on this SPA.

Status of SPA 6

A presentation was provided on the fishery, survey, and advice for SPA 6. Details can be found in the associated Research Document (Smith et al. 2012) and SAR (DFO 2012) for this meeting.

Reviewer Comments

Comment 6: In a time when integration across ecosystem and species interactions are being adopted/encouraged, the breakdown into so many subareas make integration of the ecosystem even more difficult.

Comment 7: Identification of temporal trends in bottom temperatures, SST, habitat area, key predators and food items may provide some more useful context.

Response: The assessment team is collecting bottom temperature information. Survey samples would be the best view of temperature. Some data are collected during the groundfish survey, but not much data is collected in the BOF. Diatoms not able to be distinguished from suspended matter, and predators (starfish, rock crab, lobster, sea snails, some finfish, hagfish) are not monitored.

Discussion

It was asked whether commercially exploited species are a major player. The response was that lobster and rock crab (bait but not commercial) are important. A rock crab fishery was attempted again this year.

It was asked whether a multi-species model has been tried. The response was that the effect of predators on natural mortality would have to be built in. Currently, the assessment uses clappers as a proxy for natural mortality (fishery would remove shell or break it apart).

It was asked why there is no model for this area. The response was that it has very patchy distribution of scallops. The assessment uses the repeated station information to detect change given uneven survey coverage. No model has been attempted.

It was noted that the numbers and weights per tow are the same in this area as in other areas. However, it is not expanded to the full area as there is untowable area. This could result in an underestimate if the 0.4 was applied to the weights. Some area would have to be estimated in order to expand to get a biomass.

It was asked why the average catch was not used as a reference here. The response was that there is no decision rule in place for this area. It is an area that requires more attention.

Bycatch

A description of the rationale, sources of data for, and results of the bycatch analysis was provided. Additional information is available in the Research Document (Smith et al. 2012), Technical Report (Sameoto and Glass 2012), and SAR (DFO 2012) associated with this meeting.

Discussion

It was suggested that the Species At Risk Act (*SARA)* bycatch be ordered by amount rather than species name.

It was noted that kilograms of bycatch per pounds of scallop meats is used for Georges Bank, which will lead to different values depending on the TAC (i.e., scaling to catch). There is a desire to use a standard method to apply across different programs. However, there was some agreement that a rate would be better than a total estimate by fleet.

There were some questions about the spatial distribution of byactch, and whether there are areas where there are higher levels of bycatch.

It was noted that the Marine Stewardship Committee (MSC) requires that attention is given to any species that is greater than 5% of the catch, i.e., an explanation is typically required.

It was noted that 6000 t of sponges was caught. This is extrapolated to the total catch. Sponges will not be caught everywhere, and these types of caveats are explained in the technical report. This report acknowledges the seasonal and spatial variation in bycatch. It was felt that there is a need for higher observed coverage and more regular coverage. However, the results provided are the best numbers based on the available data. A lot of work was done to make sure the data was recorded properly (and corrected if not). Any data that was suspicious was excluded. However, sponges are attached to rocks, and rocks are included in the weight. The smallest piece of sponge (or anything else) that can be recorded is 1 kg (i.e., even a smaller piece of sponge is recorded at 1 kg).

It was noted that the table includes scallop discards, which look like they are close to the TAC. It was noted that this was shell weight and not round weight, so it should be divided by the shell (8.3).

It was clarified that Area 1, 4, 5 and some updated numbers will be in the final Research Document.

The Technical Report will be circulated to participants when available.

It was asked whether a process will be developed to determine future need, as it is not on anyone's radar to repeat this work. MSC may set a target of about 5%. DFO's list of priorities would also have to be considered. MSC is being used as a proxy for what DFO might do.

Habitat Impacts

It was noted that this fishery does have a benthic footprint that can be determined in part from the Vessel Monitoring System (VMS). Some progress has been made on this analysis, i.e., processing of the VMS and matching it to logs. However, work is still needed on what habitat is potentially being impacted. While multibeam mapping has taken place in some areas, the only available products are the bathymetry and backscatter. Ground-truthed habitat maps have not been developed.

Discussion

It was asked what the Resource Management and MSC expectations were in terms of an analysis of habitat impacts. It was agreed that this should be clarified for next year. If there are specific expectations, these should be included in the Terms of Reference for the next assessment.

It was suggested that an evaluation of the fishery footprint in terms of total area impacted over some timeframe (e.g., km^2 per year) might be considered. This might be evaluated against any benthic classification or mapping information that was available at the time.

SUMMARY OF DAY ONE

Assessment Approach: Area-Based Advice

There seem to be some concerns about how areas are partitioned in this assessment. In some cases there is concern that there are too many assessment units (industry concern with division of SPA 1B, reviewer's concern with looking at trends over time), and in some cases there is concern about too much aggregation (e.g., suggestion to separate St. Mary's Bay out from the rest of SPA 3). There were concerns also from the reviewer about bisecting centers of distribution.

Consensus seems to be that management, with industry, needs to confirm the areas that they need advice for. Science will summarize the information as required, but this willnot change how the data is collected. If management needs advice from science on what these management areas should be, this should be included in the remit for the next assessment.

It was also suggested that there might some comparisons that should be made across all areas. For example, condition tends to be going down in most areas, with an increase in 2011 in some areas (inshore SPA 1A, Briar/Lurcher, SPA 4), except St. Mary's Bay, which has shown an increase since 2006 (with recent drop in 2011). Also recruitment is currently at low levels (mostly).

The science recommendation from Day One was the separation of St. Mary's Bay from the rest of SPA 3. However, is it expected that industry would not want to see it separated for management purposes.

Data Inputs

Catch

It seems as though unreported catch is known to occur, with some gut feelings about the extent (20-30% range has been mentioned many years). However, evaluation of available data has not provided any evidence to support this. Next steps would be for DFO's Conservation and Protection group to conduct a forensic audit, which may or may not provide useful information. This is a source of uncertainty – leading to a potential tendency of the model to over-estimate biomass. However, it is not a major concern (in terms of trends) unless it has changed in magnitude through the assessment time period.

This assessment does not currently account for removals from some other fisheries (e.g., lobster fishery) or potential unreported catches in the scallop dive fishery. There is limited reporting of the Food, Social and Ceremonial removals.

The recommendation from Day One was to determine if there is information available on removals from the scallop dive fishery that could be estimated and incorporated into the catch.

Growth

A revised growth model has been applied this year, which takes into account the variability in growth better and seems to have improved the model fit. The current assessment makes assumptions about next year's growth (that it's the same as the current year), which are not always accurate. There have been some large annual changes in growth, with some years of negative growth. This is considered a major source of uncertainty, which can lead to over or under-estimates of biomass.

Discussion

It was clarified that the same growth model is being used (i.e., no changes to how growth is spatially modeled), but this year parameters are expressed as condition instead of shell height / meat weight. It is a spatial growth model with random effects built into it. Condition provides the conversion from height to weight. An empirical g is used instead of a theoretical one. In previous years, growth was based on average meat weight. Using the von Bertalanffy growth model builds in an expectation of growth that was not consistent with what was seen in the survey. There is much more variability in the population than predicted, and lean years (in terms of condition) were not adequately modeled in the previous version of the model. The model expected the population to grow more given the size of the scallops (i.e., small scallops grow faster), when in fact they were just poor condition. When condition was going down, the model tried to force the population to grow faster when it should be growing slower.

Recruitment

The recruitment index comes from the survey catches (lined gear). The index of recruitment tends to pick up strong and weak signals but is not good at distinguishing the middle range. In general, there are periods of low levels of recruitment with rare large recruitment events. Sometimes pre-recruits disappear before they enter the fishery.

Discussion

Recruitment may be related to condition. There have been two major recruitment events in the Bay of Fundy in recent history – one with good growth data (1998 year-class) and one without

data (1984-85 year classes). One of the large Bay of Fundy scallop year-class events occurred during a time of good growth, but this is not always the case. On Georges Bank, there has been a large recruitment event in a period of poor condition. Current recruitment on Brown's Bank is also occurring in a period of low condition.

Natural Mortality

The estimate of natural mortality is based on a clapper index, which may be useful in detecting large mortality events. As with recruitment, this index is not good at resolving "in between" values. The model assumes that next year's natural mortality will be the same as the current year. However, natural mortality is generally fairly stable and is not considered to be as big an issue as growth.

Discussion

A question was asked about the cause of the 1989 clapper event. The response was that only circumstantial evidence exists. There was a mass mortality event off Florida with symptoms similar to what was seen in the Bay of Fundy. A smaller epidemic broke out on the coast of Maine. Americans stored and analyzed tissue samples, and they identified a protozoan not native to North America that is generally found in oysters. It may have been transported in ballast water, which could explain its introduction to the Bay of Fundy. Samples from the Bay of Fundy were sent to the US for investigation, but it was not possible to analyze them as they were poorly sampled. For a time, there was concern that this could impact the large scallop year-class, so a sampling program was implemented to check for it. In the end, it was not an issue. The protozoan may not have been able to survive the Canadian winter.

Biomass Index

The biomass index is based on survey numbers and condition.

Condition was discussed on Day One. The assessment assumes that condition in the current year will be the same as the subsequent year, which is a source of uncertainty. It was noted that condition varies seasonally. Ideally, condition is compared at the same time each year, but this is not always the case when survey timing changes. Condition is declining in many locations, but it is not clear why. Factors that might influence condition, like plankton, are not easy to resolve to the scale necessary in the Bay of Fundy (ocean color issues). There was a suggestion to investigate catch rates in areas of low versus high condition. It would be nice to have historical records of how low condition might go (i.e., what is the bottom). It was suggested that doing a Management Strategy Evaluation might be useful, including investigation of sensitivity of the management regime to uncertainties in condition (among other things).

Work on survey and fishery catchabilities in Quebec has indicated that they may be higher than expected. Right now, these are used as bounds in the model. There are no measurements of survey qs, but they are generated from the model – vary from area to area and seem to match with expectations based on habitat type. There was some discussion of the perceived inefficiency of the survey gear, with the proposal that delivery of a new survey vessel may be the time to buy new survey gear and do some comparison tows.

Other Indicators

CPUE is used as a check on the model results, but it is not standardized. It is surprisingly consistent with the survey trends in most areas, except SPA 3 for 4 years.

A question was asked about the maximum size in an unfished population.

Bottom temperature is collected but is not currently used in the assessment.

Predators not typically monitored. Prey is hard to resolve from ocean color data.

Model

In general, there do not seem to be too many concerns expressed about the model results. Diagnostics look pretty good this year given the improvements made.

However, industry feels there is more scallop biomass than is observed by the survey in Area 3. Improvements have been made to try to address this, including redesign of the area considered in the survey index to include only the recently fished areas. This improved the survey fit to the CPUE. Still, there are a few years where there are inconsistencies in the trend (which is ok – they do not have to match perfectly).

Several suggestions were made:

- look at the sample size in the years where the trends do not match,
- look at the proportion of spring and fall records (potentially influenced by timing of the spring bloom),
- show how removing one area previously fished influences the survey trends,
- estimate the biomass in SPA 3 outside the fished area, and
- consider adding the CPUE into the tuning of the model for SPA 3.

Other assessment methods have been suggested in the past, including use of a video/camera survey if money was not an option. If money was available to do some camera work, perhaps the fished area within SPA 3 would be a place to do it.

Reference Points

Additional discussion is required on reference points, e.g., the appropriateness of providing advice in terms of 0.15 exploitation (above which biomass tends to decline), and potential next steps.

Advice

No concerns were expressed with the advice tables for SPAs 1A, 1B, and 4, but there was some concern from industry with the advice for SPA 3.

For SPA 5, advice is based on an average catch.

For SPA 6, only a trend is provided. In order to expand the survey catch to a biomass estimate, an assessment area would have to be defined, which would be hard to do. Other factors include a stable CPUE, low recruitment, and a decline in condition.

Bycatch

Bycatch information was presented from the *SARA* project in 2008/2009. There was lots of discussion of its limitations and issues with the methodology. Aside from that, information on bycatch within each fishery is of high importance to DFO (not just for MSC purposes). It has been on the Terms of Reference since 2007, and additional coverage was put on this fishery because it was identified as a gap. DFO's interest is in any commercial species caught in significant numbers (to potentially be accounted for in other assessments) and in potential *SARA* species caught (e.g., Striped Atlantic Wolffish). MSC interest is in species that make up greater than 5% of the catch.

Recommendation: Order species by weight (total or average), and a reasonable request to provide the percentage by scallop weight. Also, the top species caught and any *SARA*-listed species that were caught (however few) should be reported in the SAR.

Usefulness of bycatch information from the survey was not discussed (i.e., not an indication of the fishery bycatch). However, this could be a check on species potentially caught in the survey gear or species of interest present in the scallop fishing areas. One question might be whether anything of note was caught in the survey that was not reported in the observer coverage.

Discussion

It was noted that when the scallop fishery catches lobster, the vessels typically move out of the area to avoid them.

It was suggested that the Gaveris et al. (2010) report be circulated to participants. However, it was noted that the inshore scallop information in that report is not accurate (as it is based on SFA 29).

It was agreed that the percentages would be provided by weight, as it is problematic to do it by effort.

It was noted that the survey gear and commercial gear are different, and the time of year is different; this should be described as context. It would be useful to include the number of obsesved trips in Table 11 (better than observed days).

It was suggested that survey bycatch not be included in the Bycatch section. It is useful information for other purposes, such as an index for another species' assessment. It could be used to describe the types of species caught during the survey, but it is not meant to be inclusive of all species caught. There have been other studies to look at community composition. It was also suggested that the trends should be shown instead of total numbers. The proportion (discard rate) multiplied by total landings (observed kg and landed kg) is available.

It was noted that a minimum weight of 1 kg is still used by some observers. This is a minimum weight for a tow, not for an individual. If only one is caught (or 10) could still be 1 kg. It would be useful if the numbers of individuals were also included.

It was asked whether survey results would not be better than the commercial bycatch, since more precise methods are used. However, it was noted that the survey does not occur at the same time as the fishery.

It was noted that Resource Management will be compiling a report that will combine all the bycatch results and compare/update these new results to the previous Gavaris et al. (2012) report.

Habitat

Evaluation of potential habitat impacts within fisheries assessments has been requested for some time, if not specifically within the Terms of Reference for this assessment until this year, and has been considered a priority by Maritimes DFO (not just for MSC purposes). Other fisheries have attempted to address this to varying degrees. The scallop assessment team has provided a few avenues for investigation, including processing of VMS data to help calculate a more accurate footprint of the fishery (clarify what are the barriers to completing this / time required to develop the methodology). If this is not possible, is there an alternative method for providing an estimate of the fishery footprint each year (that could be refined over time)? The assessment team also described how the fishery footprint could then be overlaid on a habitat

map (e.g., analysis and groundtruthing of backscatter from multibeam). Other options could be investigated, such as the habitat classification developed by M. Greenlaw and A. Gromack, or a comparison of the footprint in relation to any EBSAs that may be identified during the MPA Network peer review meeting. Some of the challenges involved in moving from an analysis of the interactions between the fishery and habitat to an analysis of the impact were highlighted. However, this issue will not be going away, so we do need to give this some additional consideration.

Discussion

Multibeam has been done for the whole Bay of Fundy, and Natural Resources Canada has provided the bathymetry and backscatter from this. However, they will not be producing habitat maps. There is also an OLEX dataset available, which does provide bathymetry. Some industry members are doing their own habitat mapping.

"Managed disturbed areas" is an objective in the Integrated Fisheries Management Plan, so it is important to address.

It was asked how many years there has been VMS. The response was that VMS has been pretty good since 2004. It is patchy in some areas.

It was noted that a methodology is being developed by the Ecosystem Research Initiative, which will be completed with a product by the end of the year.

PRESENTATION OF NEW DATA

Some options were presented on how to deal with the lack of consensus on Area 3; for example, a statement can be included in the SAR, as well as in the proceedings, that industry is not supportive of the advice that has been provided, and briefing material could be prepared for the Regional Director General. It was agreed that there should be a plan in place to address this issue before the ISAC meeting on December 8, 2011.

It was suggested that if there are two different views of the world, there is a need to present the consequences of the decisions made using both views. The risks involved in different approaches should be described. Also, evidence should be collected to resolve the issue, or at least a plan should be presented for how the evidence will be collected.

Yesterday, there was discussion about how the survey was designed around the VMS data from 2002-2010 (red hatched area). Saw that the modeled biomass trend was not matched with the CPUE trend for 4 years from 2006-2009. When the area that has not been fished recently is removed, it does have some impact on the trend.

It was asked what the biomass is outside the fished area. The response was that, essentially, the area outside is much larger than the fished area but the density is a quarter that of the fished area. When you put it together, get about the same biomass outside the fished area as inside the fished area but at a low density. Catch rates would likely be lower.

In an experimental approach, it might be possible to ask some people to fish in the low density area next year to see if the survey results are correct. This is different for Area 4, which is fishable throughout even though the fishery tends to be concentrated.

It was clarified that the wrong area factor was used for St. Mary's Bay (too small an area was used in the model). Once it was changed and reran, it did improve the outlook a little, but there likely still will not be consensus. There is now a 5% decline instead of a 14% decline. The table includes St. Mary's Bay (all stations) and Briar/Lurcher (inside the VMS polygon).

It was noted that the fishery could be sacrificing yield by limiting TAC now, and condition has improved.

It was asked whether there was an established link between adult density and recruitment for this area, and whether fishing out the fished area would impact recruitment or fecundity. The response was that the answer is not clear. For some species, it is not desirable to fish out the high productivity areas.

It was noted that the model includes catch for the whole area (since 1997), while the survey is just the fished area for the time series; there are no catches by area. There was some concern about mixing areas within the model.

It was proposed that there should be a quota outside the fished area. If there is a desire to manage it differently, would need some advice on how to do that. Could partition the catch inside and outside the fished area, which would take some time, but it could be done if management requested it. The fishery would to know how much overhead they were willing to take for small returns.

It was asked whether the figure where the "patch" is removed should be included in the SAR or the Research Document. It was agreed that it should be included in the Research Document to help explain the difference in the change in trend.

It was noted that CPUE was recalculated and there is no longer a need to look at the proportions between spring and fall.

There was some further discussion of the interpretation of catch rate trend. It is possible that the fishery fished out the large peaks initially, and it has been fairly stable since. Something has been presented on this for industry previously. Percentage of catch landed were broken out by catch rate interval. During the peak, there were very high catch rates. Catch rates then declined, with a small increase with some recruitment.

RESEARCH RECOMMENDATIONS

There was discussion on the use of camera/video surveys. Visual surveys (developed by Woods Hole) have been used in the Gulf of Alaska for weathervane scallops. These are being adopted for Georges Bank. However, they are having vessel issues (new vessels not to be used for scallop dredging). They are also developing software for species recognition. Last year, they were getting about 80%, but it is improving. Ocean Physics has put forward a proposal for a habitat cam. The tow cam system that has been used in the past is now obsolete. As with previous years, it was noted that samples would still need to be collected, and comparative work would be required. The selling features of these surveys are that they are less obtrusive and good for seeing other features or species. There are some catchability issues, but it could be used to monitor recruitment in closed areas.

The Management Strategy Evaluation for pollock was able to evaluate the consequences of missing survey years. It does make strong assumptions about recruitment, however, that cannot be made for scallops.

If the survey is not done every year, the CPUE trends might become more useful, as we would still be getting CPUE every year. However, it is still going to miss recruitment. There is a need to think about what can be done if there is no survey vessel available, particularly how to deal with recruitment; for example, assume a low level of recruitment, with occasional high recruitment events. If it is assumed that there is a small level of recruitment, the catch levels will have to be way lower. Can make an adjustment to the TAC if the fishery sees evidence of recruitment.

It should be noted that this scallop assessment is in much better shape than in many groundfish assessments. It may even be possible to develop some decision rules.

It was suggested that St. Mary's Bay be separated out from the SPA 3 model

It was suggested that CPUE be included in the model fitting for SPA 3.

It was suggested that target and limit reference points should be established, and it was noted that this was supposed to be done for the Reference Points Peer Review meeting in spring 2012.

It was suggested that a fishery footprint be calculated from VMS data, with habitat classification overlay and some consideration of potential habitat impacts into the future.

CLOSING REMARKS

A proceedings will be prepared that documents the key discussion points and conclusions from the meeting.

The revised SAR will be circulated to participants, who will be given a few days to comment. Silence will be considered as consent.

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APPENDICES

Appendix 1a. List of Participants: 11-12 December 2008

Assessment of Bay of Fundy Scallop
Maritimes Region Science Advisory Process

Ron Trites Boardroom
Bedford Institute of Oceanography

11-12 December 2008

ATTENDEES

Name	Affiliation
Butler, Maureen	DFO Maritimes / FAM
Clark, Kirsten	DFO Maritimes / SABS
Claytor, Ross	DFO Maritimes / PED
Cronk, Ron	NB Dept. of Fisheries
Greening, Linde	NS Fisheries and Aquaculture
Hazelton, Reg	Full Bay Scallop Assn. (FBSA) / O'Neil Fisheries
Hazelton, Vance	Full Bay Scallop Assn. (FBSA)
Hurley, Peter	DFO Maritimes / PED
Jonsen, Ian	DFO Maritimes / PED
Lewis, Bert	Eskasoni Fish & Wildlife Commission (EFWC)
Lundy, Mark	DFO Maritimes / PED
McIntyre, Tara	DFO Maritimes / PED
Nicholas, Hubert	Unama'ki Institute of Natural Resources (UINR)
Perley, Neil	Maliseet Nation Conservation Council (MNCC)
Robarts, Tom	Upper Bay Scallop Fishermen's Assn. (LFA 35)
Sameoto, Jessica	DFO Maritimes / PED
Sanford, Jon	Alma Scallop Fishermens Assn.
Smith, Stephen	DFO Maritimes / PED
Stewart, Dick	Atlantic Herring Co-op
Tremblay, John	DFO Maritimes / PED
Waters, Christa	DFO Maritimes / FAM
Wentzell, Ian	APCFNC Secretariat
Whynot, Zach	TriNav Fisheries Consultant Inc.
Worcester, Tana (Chair)	DFO Maritimes / CSA

Appendix 1b. Terms of Reference: 11-12 December 2008

Assessment of Bay of Fundy Scallop
Maritimes Region Science Advisory Process

Ron Trites Boardroom
Bedford Institute of Oceanography

11-12 December 2008

TERMS OF REFERENCE

Context

In support of the fishery for scallop in the Bay of Fundy (Scallop Production Areas [SPAs] 1, 3, 4, 5, and 6), DFO Maritimes Fisheries and Aquaculture Management has asked Science for an assessment of resource status and the consequences of various harvest levels for the coming fishing season. The current meeting is a scientific review of the assessment and projections undertaken in support of the 2009 fishery.

Objectives

For each of SPAs 1, 3, 4, 5, and 6:

- Assess the status of scallop stocks by SPA, taking into account available commercial and survey information. In addition, the assessment model used in CSAS Research Document 2003/10 should be applied for SPAs 1A, 1B, 3, and 4.
- Evaluate bycatch of non-scallop species during the 2008 fishery.
- Evaluate the consequences of different harvest levels during the 2009 fishery on stock abundance and exploitation rate by SPA. For SPA 1B, these consequences should be provided for subareas SFA 28C, 28D, and the rest of SPA 1B (SFA 28B minus SPA 6).

Outputs

CSAS Science Advisory Report (separate section of report for each SPA)
CSAS Proceedings
CSAS Research Document

Participation

DFO Science
DFO Fisheries and Aquaculture Management
Aboriginal communities / organizations
Provincial (NS and NB) governments
Industry

Appendix 1c. Agenda: 11-12 December 2008

Assessment of Bay of Fundy Scallop
Maritimes Region Science Advisory Process

George Needler II Boardroom
Bedford Institute of Oceanography

17 November 2008 (18th if required)

DRAFT AGENDA

17 November 2008 – Monday

09:00-09:15	Introduction
09:15-10:00	Review of SPA 1A analyses
10:00-10:15	Break
10:15-11:00	Review of SPA 1B analyses
11:00-11:30	Review of SPA 3 analyses
11:30-12:00	Review of SPA 4
12:00-13:00	Lunch
13:00-13:30	Review of SPA 5
13:30-14:00	Review of SPA 6
14:00-15:00	Review of SAR
15:00-15:15	Break
15:15-16:00	Review of SAR (continued)

18 November 2007 – Tuesday

09:00 -12:00	Review of SAR (only if required)

Appendix 2a. List of Participants: 9 November 2009

Assessment of Bay of Fundy Scallop
Maritimes Region Science Advisory Process

Hayes Boardroom
Bedford Institute of Oceanography

9 November 2009

ATTENDEES

Name	Affiliation
Amero, Keith	Full Bay Scallop Assn. (FBSA)
Butler, Maureen	DFO Maritimes / FAM
Clark, Kirsten	DFO Maritimes / SABS
Cronk, Ron	NB Dept. of Fisheries
Denny, Leon	Eskasoni Fish & Wildlife Commission (EFWC)
Denny, Leonard	Eskasoni Fish & Wildlife Commission (EFWC)
Gibson, Jamie	DFO Maritimes / PED
Glass, Amy	DFO Maritimes / PED
Hamilton, Greg	Upper Bay Scallop Fishermen's Assn. (LFA 35)
Hazelton, Reg	Full Bay Scallop Assn. (FBSA) / O'Neil Fisheries
Hazelton, Vance	Full Bay Scallop Assn. (FBSA)
Hubley, Brad	DFO Maritimes / PED
Hurley, Peter	DFO Maritimes / PED
Lundy, Mark	DFO Maritimes / PED
Nicholas, Hubert	Unama'ki Institute of Natural Resources (UINR)
Perley, Neil	Maliseet Nation Conservation Council (MNCC)
Robarts, Tom	Upper Bay Scallop Fishermen's Assn. (LFA 35)
Sameoto, Jessica	DFO Maritimes / PED
Smith, Stephen	DFO Maritimes / PED
Stewart, Dick	Atlantic Herring Co-op
Waters, Christa	DFO Maritimes / FAM
Worcester, Tana (Chair)	DFO Maritimes / CSA

Appendix 2b. Terms of Reference: 9 November 2009

Assessment of Bay of Fundy Scallop
Maritimes Region Science Advisory Process

Hayes Boardroom
Bedford Institute of Oceanography

9 November 2009

TERMS OF REFERENCE

Context

In support of the fishery for scallop in the Bay of Fundy (Scallop Production Areas [SPAs] 1, 3, 4, 5, and 6), DFO Maritimes Fisheries and Aquaculture Management Branch has asked DFO Science for an assessment of resource status and the consequences of various harvest levels for the coming fishing season.

Given that Bay of Fundy scallop have a long and well documented history of CSAS assessments, the assessment approach has been accepted in previous meetings, and the assessment results are not expected to be controversial in 2009, it was determined that a condensed Bay of Fundy scallop assessment would be conducted in 2009. This means that the assessment approach would not be reviewed this year. Instead, only the assessment results and projections will be reviewed. Background documentation will consist of the Research Document from last year and the draft Science Advisory Report for 2009.

Objectives

For each of SPAs 1, 3, 4, 5, and 6:

- Assess the overall status of the Bay of Fundy scallop stocks as of the end of 2009.
- Assess the status of scallop stocks by SPA (SPA 1A, subareas of SPA 1B, SPA 3, 4, 5, and 6), taking into account available commercial and survey information.
- Evaluate bycatch of non-scallop species during the 2009 fishery.
- Evaluate the consequences of different harvest levels during the 2009/2010 fishery on stock abundance and exploitation rate by SPA. For SPA 1B, these consequences should be provided for subareas SFA 28C, 28D, and the rest of SPA 1B (SFA 28B minus SPA 6).
- Determine, if possible, an interim harvest level for 2010/2011.

Outputs

CSAS Science Advisory Report
CSAS Proceedings

Participation

DFO Science
DFO Fisheries and Aquaculture Management
Aboriginal communities / organizations
Provincial (NS and NB) governments
Industry

Appendix 2c. Agenda: 9 November 2009

Assessment of Bay of Fundy Scallop
Maritimes Region Science Advisory Process

Hayes Boardroom
Bedford Institute of Oceanography
9 November 2009

DRAFT AGENDA

9 November 2009 – Monday

9:00-9:15	Introduction
9:15-10:00	Review of SPA 1A
10:00-10:30	Review of SPA 1B
10:30-11:00	Break
11:00-11:30	Review of SPA 6
11:30-12:00	Review of SPA 5
12:00-13:00	Lunch
13:00-13:30	Review of SPA 3
13:30-14:00	Review of SPA 4
14:00-14:30	Break
14:30-end	Review of SAR

Appendix 3a. List of Participants: 16-17 November 2011

Maritimes Region Science Advisory Process
Assessment of Bay of Fundy Scallop

Hayes Boardroom
Bedford Institute of Oceangraphy

16-17 November, 2011

ATTENDEES

Name	Affilication
Bourdages, Hugo	DFO Science, Quebec Region
Butler, Maureen	DFO Resource Management, Maritimes Region
d'Entremont, Alain	Scotia Harvest Seafoods
Glass, Amy	DFO Science, Maritimes Region
Hazelton, Reg	Full Bay Scallop Assn. (FBSA) / O'Neil Fisheries
Hazelton, Vance	Full Bay Scallop Assn. (FBSA)
Hubley, Brad	DFO Science, Maritimes Region
Hurley, Peter	DFO Science, Maritimes Region
Murphy, Bill	Fisherman's Market International Inc.
Nasmith, Leslie E	DFO Science, Maritimes Region
O'Boyle, Robert	Beta Scientific Consulting Inc.
O'Brien, John M	Ecosystems and Oceans Science
Sameoto, Jessica	DFO Science, Maritimes Region
Smedbol, Kent	DFO Science, Maritimes Region
Smith, Stephen	DFO Science, Maritimes Region
Stewart, Dick	Atlantic Herring Co-op
Thompson, Greg	LFA 36, Fundy North Fishermen's Assn.
Worcester, Tana	DFO Science, Maritimes Region

Appendix 3b. Terms of Reference: 16-17 November 2011

Assessment of Bay of Fundy Scallop
Maritimes Region Science Advisory Process

Bedford Institute of Oceanography
Dartmouth, NS

16-17 November 2011

TERMS OF REFERENCE

Context

In support of the fishery for scallop in the Bay of Fundy (Scallop Production Areas [SPAs] 1, 3, 4, 5, and 6), DFO Maritimes Fisheries and Aquaculture Management Branch has asked DFO Science for an assessment of resource status and the consequences of various harvest levels for the coming fishing season. The last assessment of Bay of Fundy Scallop was conducted in November 2009.

Objectives

For each of SPAs 1, 3, 4, 5, and 6:

- Assess the status of scallop stocks by SPA (SPA 1A, subareas of SPA 1B, SPA 3, 4, 5, and 6), taking into account available commercial and survey information.
- Present the bycatch species from all available data.
- Evaluate possible habitat impacts of the fishery.
- Evaluate the consequences of different harvest levels during the 2011/2012 fishery on stock abundance, exploitation rate, and interim harvest levels for 2012/2013 using the established exploitation reference points.

Expected Publications

CSAS Science Advisory Report
CSAS Proceedings
CSAS Research Document

Participation

DFO Science
DFO Fisheries and Aquaculture Management
Aboriginal communities / organizations
Provincial (NS and NB) governments
Industry

Appendix 3c. Agenda: 16-17 November 2011

Assessment of Bay of Fundy Scallop
Maritimes Region Science Advisory Process

Hayes Boardroom
Bedford Institute of Oceanography

16-17 November 2011

DRAFT AGENDA

16 November 2011 – Wednesday

9:00-9:30	Introduction
9:30-10:15	Review of SPA 1A
10:15-10:45	Review of SPA 1B
10:45-11:00	Break
11:00-11:30	Review of SPA 4
11:30-12:00	Review of SPA 3
12:00-13:00	Lunch
13:00-13:30	Review of SPA 5
13:30-14:00	Review of SPA 6
14:00-14:30	Break
14:30-15:00	Review of Ecosystem Information
15:00-16:30	Conclusions / Discussion

17 November 2011 – Thursday

9:00-9:15	Review of Previous Day
9:15-10:30	Review of SAR
10:30-11:00	Break
11:00-12:00	Review of SAR (con)
12:00-13:00	Lunch
13:00-end	Review of SAR (as required)